Why Program?

Chapter 1

Python for Informatics: Exploring Information
www.pythonlearn.com

open.michigan

University of Michigan

School of Information

Pre-Requisite: Please Install Python

PythonLearn Book Install Informatics Instructor Python About

Setting up your PythonLearn Devlopment Environment

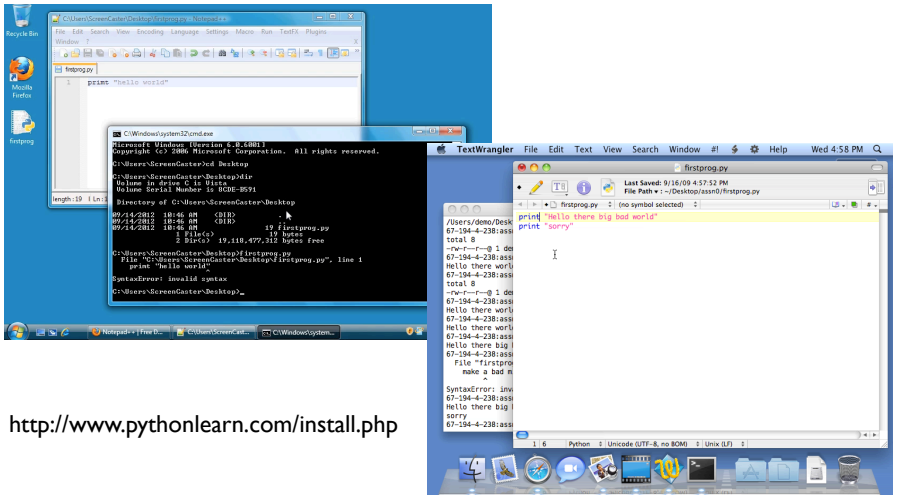
We have separate pages for each of the commonly used Operating Systems:

- Setting up the PythonLearn Environment in Microsoft Windows
- Setting up the PythonLearn Environment on a Macintosh

Note: Make sure that you install the latest version of Python 2.x - do not install Python 3.x. There are signficant differences between Python 2 and Python 3 and this book is still Python 2.

You will need Quicktime (or iTunes) installed on your computer to view any video materials or screencasts. You should probably download the high quality copies of these files or screencasts to your computer and view/play them locally. They are rather large files and you will want to move back and forth as well as start and stop the podcasts so you can perform the steps as indicated.

http://www.pythonlearn.com/install.php



http://www.pythonlearn.com/install.php

Back to the Introduction...

Computers want to be helpful...

- Computers are built for one purpose - to do things for us
- But we need to speak their language to describe what we want done
- Users have it easy - someone already put many different programs (instructions) into the computer and users just pick the ones we want to use

What Next? What Next? What Next?

What Next? What Next? What Next?

Programmers Anticipate Needs

- iPhone Applications are a market
- iPhone Applications have over 3 Billion downloads
- Programmers have left their jobs to be full-time iPhone developers
- Programmers know the ways of the program

Pick Me! Pick Me! Pick Me!

Pick Me! Pick Me! Pay Me!

Users .vs. Programmers

- Users see computers as a set of tools - word processor, spreadsheet, map, todo list, etc.
- Programmers learn the computer "ways" and the computer language
- Programmers have some tools that allow them to build new tools
- Programmers sometimes write tools for lots of users and sometimes programmers write little "helpers" for themselves to automate a task

User

Why be a programer?

- To get some task done - we are the user and programmer
  - Clean up survey data
- To produce something for others to use - a programming job
  - Fix a performance problem in the Sakai software
  - Add guestbook to a web site

What is Code? Software? A Program?

- A sequence of stored instructions
  - It is a little piece of our intelligence in the computer
  - It is a little piece of our intelligence we can give to others - we figure something out and then we encode it and then give it to someone else to save them the time and energy of figuring it out
- A piece of creative art - particularly when we do a good job on user experience

Programs for Humans...

http://www.youtube.com/watch?v=vlzwuFkn88U
http://www.youtube.com/watch?v=sN62PAKoBfE

Programs for Humans...

while music is playing:
- Left hand out and up
- Right hand out and up
- Flip Left hand
- Flip Right hand
- Left hand to right shoulder
- Right hand to left shoulder
- Left hand to back of head
- Right ham to back of head
- Left hand to right hit
- Right hand to left hit
- Left hand on left bottom
- Right hand on right bottom
- Wiggle
- Wiggle
- Jump

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- Right hand to back of head
- Left hand to right hip
- Right hand to left hip
- Left hand on left bottom
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- Wiggle
- Wiggle
- Jump

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the clown ran after the car and the car ran into the tent and the tent fell down on the clown and the car

Programs for Python...

Programs for Python...

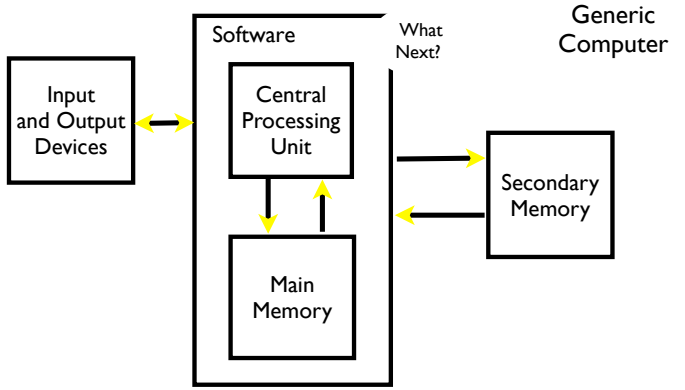
```
name = raw_input('Enter file:')
handle = open(name, 'r')
text = handle.read()
words = text.split()
counts = dict()

for word in words:
   counts[word] = counts.get(word,0) + 1

bigcount = None
bigword = None
for word,count in counts.items():
    if bigcount is None or count > bigcount:
        bigword = word
        bigcount = count

print bigword, bigcount
```

```
python words.py
Enter file: words.txt
to 16
```

```
python words.py
Enter file: clown.txt
the 7
```

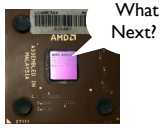
Hardware Architecture

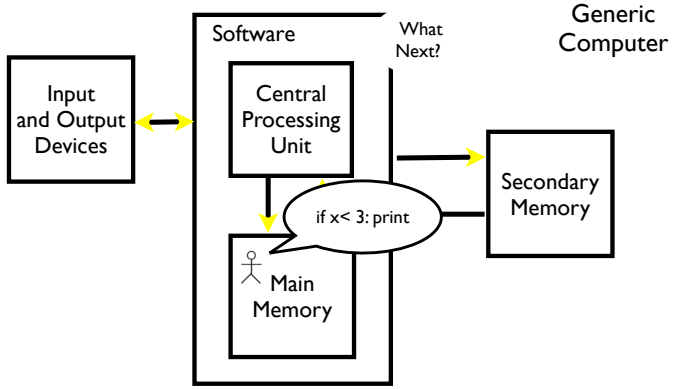
http://upload.wikimedia.org/wikipedia/commons/3/3d/RaspberryPi.jpg

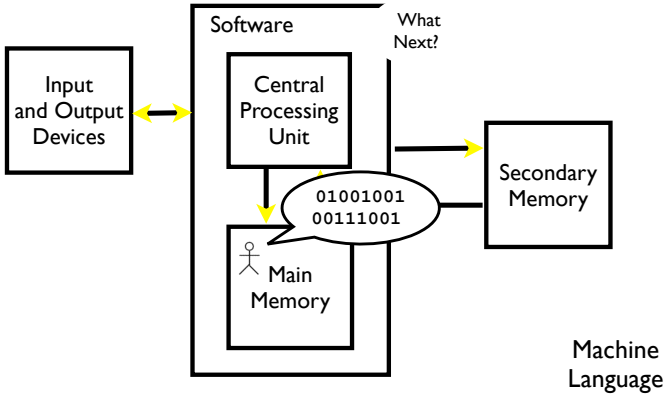


Definitions

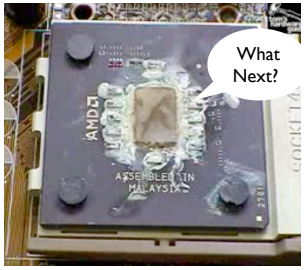
- Central Processing Unit: Runs the Program - The CPU is always wondering "what to do next"? Not the brains exactly - very dumb but very very fast
- Input Devices: Keyboard, Mouse, Touch Screen
- Output Devices: Screen, Speakers, Printer, DVD Burner
- Main Memory: Fast small temporary storage - lost on reboot - aka RAM
- Secondary Memory: Slower large permanent storage - lasts until deleted - disk drive / memory stick





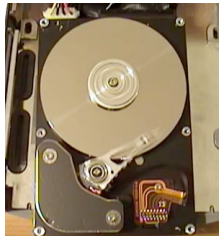


Totally Hot CPU



http://www.youtube.com/watch?v=y39D4529FM4

Hard Disk in Action



http://www.youtube.com/watch?v=9eMWG3fwiEU

Python as a Language

Parseltongue is the language of serpents and those who can converse with them. An individual who can speak Parseltongue is known as a Parselmouth. It is a very uncommon skill, and may be hereditary. Nearly all known Parselmouths are descended from Salazar Slytherin.

http://harrypotter.wikia.com/wiki/Parseltongue

Python is the language of the Python Interpreter and those who can converse with it. An individual who can speak Python is known as a Pythonista. It is a very uncommon skill, and may be hereditary. Nearly all known Pythonistas use software inititially developed by Guido van Rossum.

Early Learner: Syntax Errors

- We need to learn the Python language so we can communicate our instructions to Python. In the beginning we will make lots of mistakes and speak gibberish like small children.
- When you make a mistake, the computer does not think you are "cute". It says "syntax error" - given that it *knows* the language and you are just learning it. It seems like Python is cruel and unfeeling.
- You must remember that *you* are intelligent and *can* learn - the computer is simple and very fast - but cannot learn - so it is easier for you to learn Python than for the computer to learn English...

Talking to Python

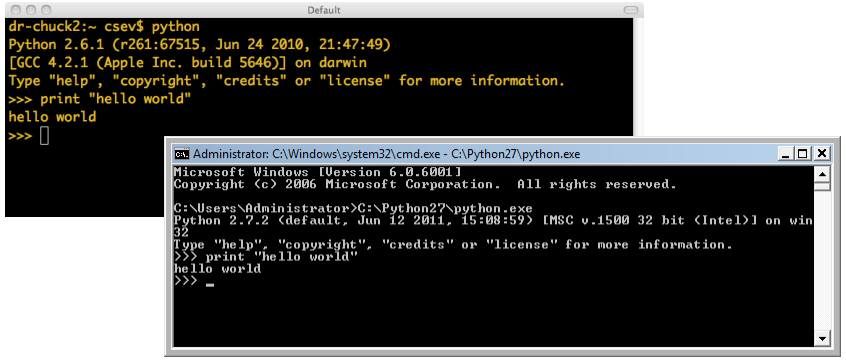
```
csev$ python
Python 2.5 (r25:51918, Sep 19 2006, 08:49:13)
[GCC 4.0.1 (Apple Computer, Inc. build 5341)] on darwin
Type "help", "copyright", "credits" or "license" for more information.
>>>
```

What next?

```
csev$ python
Python 2.5 (r25:51918, Sep 19 2006, 08:49:13)
[GCC 4.0.1 (Apple Computer, Inc. build 5341)] on darwin
Type "help", "copyright", "credits" or "license" for more information.
>>> x = 1
>>> print x
1
>>> x = x + 1
>>> print x
2
>>> exit()
```

This is a good test to make sure that you have Python correctly installed. Note that quit() also works to end the interactive session.

Lets Talk to Python...



What do we Say?

Elements of Python

- Vocabulary / Words - Variables and Reserved words (Chapter 2)
- Sentence structure - valid syntax patterns (Chapters 3-5)
- Story structure - constructing a program for a purpose

```
name = raw_input('Enter file:')
handle = open(name, 'r')
text = handle.read()
words = text.split()
counts = dict()
for word in words:
  counts[word] = counts.get(word,0) + 1

bigcount = None
bigword = None
for word,count in counts.items():
   if bigcount is None or count > bigcount:
       bigword = word
       bigcount = count

print bigword, bigcount
```

A short "Story" about how to count words in a file in Python.

```
python words.py
Enter file: words.txt
to 16
```

Reserved Words

- You can not use reserved words as variable names / identifiers

```
and   del   for   is   raise
assert   elif   from   lambda   return
break   else   global   not   try
class   except   if   or   while
continue   exec   import   pass   yield
def   finally   in   print
```

Chapter 2

Sentences or Lines

x = 2 —— Assignment Statement

x = x + 2 — Assignment with expression

print x —— Print statement

Variable Operator Constant Reserved Word

Programming Paragraphs

Python Scripts

- Interactive Python is good for experiments and programs of 3-4 lines long
- But most programs are much longer so we type them into a file and tell python to run the commands in the file.
- In a sense we are "giving Python a script"
- As convention, we add ".py" as the suffix on the end of these files to indicate they contain Python

Writing a Simple Program

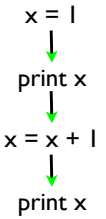
Interactive versus Script

- Interactive
  - You type directly to Python one line at a time and it responds
- Script
  - You enter a sequence of statements (lines) into a file using a text editor and tell Python to execut the statements in the file

Program Steps or Program Flow

- Like a recipe or installation instructions, a program is a sequence of steps to be done in order
- Some steps are conditional - they may be skipped
- Sometimes a step or group of steps are to be repeated
- Sometimes we store a set of steps to be used over and over as needed several places throughout the program (Chapter 4)

Sequential Steps



Program:

```
x = 2
print x
x = x + 2
print x
```

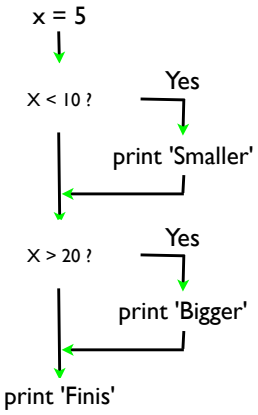
Output:

```
2
4
```

When a program is running, it flows from one step to the next.
We as programmers set up "paths" for the program to follow.

Chapter 2

Conditional Steps



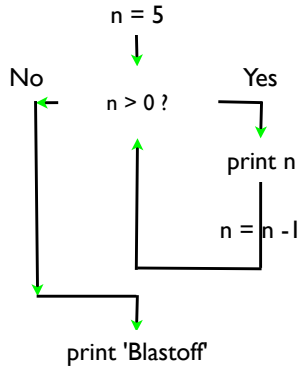
Program:

```
x = 5
if x < 10:
    print 'Smaller'

if x > 20:
    print 'Bigger'

print 'Finis'
```

Output:

```
Smaller
Finis
```

Chapter 3



Repeated Steps

Program:

```
n = 5
while n > 0 :
    print n
    n = n - 1
print 'Blastoff!'
```

Output:

```
5
4
3
2
1
Blastoff!
```

Loops (repeated steps) have iteration variables that change each time through a loop. Often these iteration variables go through a sequence of numbers.

Chapter 5

```
name = raw_input('Enter file:')
handle = open(name, 'r')
text = handle.read()
words = text.split()
counts = dict()
for word in words:
   counts[word] = counts.get(word,0) + 1

bigcount = None
bigword = None
for word,count in counts.items():
    if bigcount is None or count > bigcount:
        bigword = word
        bigcount = count

print bigword, bigcount
```

Sequential

Repeated

Conditional

An Animated Short Python Story...

Finding the largest number in a list of numbers...

```
 25  1  114 117 150 152 120  46  19 126
191 121 104 116 160 105  89 125  40  14
 31 139 113  94  97 193 154 140 195 122
112 163 177  48  78 101 130  83  35 197
 44  54 106 143  69  38  3   41  93  81
 20 164  4   11 151  8  107  71 159  65
181 178 173 148  62 142 170  72  37 145
 60 187 198  99  15  82  26  8  192  17
129  73  45  9   24 188  42 151  51 183
179  79  50  76  34  33 185 102 193 184
```

What is the Largest Number?

25	1	114	117	150	152	120	46	19	126
191	121	104	116	160	105	89	125	40	14
31	139	113	94	97	193	154	140	195	122
112	163	177	48	78	101	130	83	35	197
44	54	106	143	59	38	3	41	93	81
20	164	4	11	131	0	107	71	159	69
181	178	173	148	62	142	170	72	37	145
60	187	198	99	15	82	26	8	192	17
129	73	45	9	24	188	42	151	51	183
179	79	50	76	34	33	185	102	193	184

What is the Largest Number?

25	1	114	117	150	152	120	46	19	126
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112	163	177	48	78	101	130	83	35	197
44	54	106	143	59	38	3	41	93	81
20	164	4	11	131	0	107	71	159	69
181	178	173	148	62	142	170	72	37	145
60	187	198	99	15	82	26	8	192	17
129	73	45	9	24	188	42	151	51	183
179	79	50	76	34	33	185	102	193	184

What is the Largest Number?

What is the Largest Number?

largest_so_far | -13 41 74

```
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bigcount = None
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for word,count in counts.items():
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print bigword, bigcount
```

A short "Story" about how to count words in a file in Python.

A word used to read data from a user.

A sentence about updating one of many counts.

A paragraph about how to find the largest item in a list.

Summary

- This is a quick overview of Chapter 1
- We will revisit these concepts throughout the course
- Focus on the big picture